Evaluating retro-reflective screens to aid conspicuity of tabletop carriages at passive level crossings.

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Abstract

The aim of this project is to design and undertake an experimental evaluation of the potential effectiveness of a prototype retro-reflective strip or screen installed at level crossings for the purpose of improving the detection by motorists of tabletop carriages and other trains at the crossings. A prototype screen was produced and footage recorded of trains passing through a crossing at night. A laboratory-based experiment using the footage will be run to assess whether the screen improves detection of, and reaction time to, the presence of trains. The presentation will describe the experiment and the results.

Background

An earlier report that was prepared for the Australasian Centre for Rail Innovation (ACRI) in 2015 (LC11 Passive Crossings and Tabletop Carriages) discusses passive solutions to improve the conspicuity of tabletop carriages at railway level crossings at night. The issue to be addressed is that unladen tabletop carriages have a low profile and so may not be detected by motorists at level crossings, particularly at night, leading to an increased crash risk.

One of the countermeasures for this problem that was suggested in the report was the use of retro-reflective strips or screens on the far side of the crossing to the driver. The idea behind such installations is that they would be illuminated by a vehicle's headlights when approaching the level crossing. The presence of a passing train would intermittently obscure the retro-reflective surface, thereby alerting the driver to its presence through 'silhouetting'. An advantage for such a countermeasure is that it would be relatively inexpensive to implement at a large number of passive crossings and would require no additional energy requirements (e.g. electricity supply or battery power).

Method

A prototype retro-reflective screen was produced that was 1200mm long and 200mm wide. It was constructed from polycarbonate (a production screen would likely be made of aluminium or steel as per standard road signs) fitted with 3M Diamond Grade fluorescent material. It was attached to a sign post using cable ties (a production screen would be attached using metal pole brackets).

Following pilot testing, a suitable level crossing will be chosen at which to apply the prototype for real world testing. The retro-reflective screen will be attached to a post on one side of the crossing, facing traffic that would approach from the other side of the railway. The research team will record footage of trains passing through the crossing during both daylight and night-time hours, and with and without the treatment in place. The footage will be recorded from the point of view of the driver of a car, at two different distances from the crossing.

The footage will then be used in a laboratory-based reaction time experiment. Participants will view footage of the crossing and indicate as quickly as possible whether a train is present at the crossing. The accuracy and speed of responses will be measured (a two-alternative forced-choice reaction time

design). They will not be told about the retro-reflective screen. The clips will feature all combinations of distance from the crossing, ambient illumination, presence/absence of trains, presence/absence of the screen, and high/low beam headlights. The order of the clips will be varied between participants to prevent learning effects.

It is hypothesised that responses will be more accurate and quicker for the night-time sites with the retro-reflective treatment than for the night-time sites without the treatment. The hypothesis will be tested using multivariate analysis of variance, with appropriate post-hoc comparisons. The daytime conditions are included to check for unintended consequences.

Results and Discussion

These will be provided in the presentation, with implications drawn for the viability of the proposed countermeasure.